IMMOBILISER DEVICE

The present invention relates to an immobiliser device for a vehicle locomotive by water such as, for example, a boat or ship.

Security is a constant concern for the crew of a vessel at sea. There have been several reported incidents of the unauthorised boarding of vessels at sea by thieves from another vessel.

FR-A-2734350 describes a projectile for immobilising targets such as helicopters or ships. It comprises an explosive sub-assembly attached to a parachute by a wire. In a stowed condition the components are housed in a casing. When ejected from the casing the wire of the projectile is designed to intercept turning parts (such as helicopter rotors or propeller blades) of a target prior to the explosive being detonated.

It is an object of the present invention to obviate or mitigate the aforesaid problem and improve the security of a sea-faring vessel.

According to a first aspect of the present invention there is provided an immobiliser device for immobilising a vehicle locomotive by water, the device comprising a housing in which there is stored, in an unextended state, an elongate flexible fouling element which, in use, is designed to foul the propeller and/or motor of a target vessel, means for automatically ejecting the fouling element from the housing, means for ensuring the fouling element is maintained in an extended state once ejected from the housing, characterised in that the fouling element is supported by an inflatable member which is stowed in the housing in a deflated condition, and in that the device further comprises a source of compressed gas releasably connected to the inflatable member in the housing and for inflating the inflatable member so that it floats on water, the inflatable member having, in an inflated condition, the elongate flexible fouling element disposed therearound.

The invention improves security by allowing the crew to take action to inhibit the motion of an approaching vessel if they have reason to feel threatened. The immobiliser device is cast into the water in the path of the approaching vessel so that

the propeller is engaged by the fouling element. The device can also be used to immobilise a fleeing vessel for whatever reason.

A weight may be conveniently attached to the fouling element so that in use the drag force of the water on the weight ensures that the fouling element is maintained in an extended state. This increases the chances of the fouling element engaging and fouling the propeller.

Preferably there is provided a valve between the source of compressed gas and the inflatable member, the valve being opened so as to allow inflation of the inflatable member by removal of a pin from the housing.

At least part of the fouling element may be configured into a net construction and may be supported by support members that extend from the inflatable member.

The housing may contain more than one inflatable member, each member being connected to a common supply of compressed gas.

The housing may comprise a capsule that is designed to be launched from a launch cylinder. Preferably the capsule has a nose that forms the source of compressed gas.

The inflatable member may be stored in the deflated condition in the form of a wound coil.

In a preferred embodiment the fouling element is attached to a projectile member that, in use, is discharged from the housing so as to carry the fouling element out of the housing. The projectile member is designed to float on the water.

According to a second aspect of the present invention there is provided an immobiliser device comprising at least one inflatable member around which is disposed an elongate flexible fouling element, the inflatable member being stored in an deflated condition and connected to a source of compressed gas via a gas distributor, and a valve in the gas distributor that is openable to allow communication between the source of compressed gas and the inflatable member.

Specific embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a schematic representation of the inflatable member of the present invention shown in the inflated condition;

Figure 2 is a diagrammatic plan view of a vessel showing the location of the immobiliser device of the present invention;

Figure 3 is a sectioned side view of a schematic representation of a housing of the immobiliser device;

Figures 4a to 4c are side, front and plan view respectively of a second embodiment of the present invention designed for the stern of a vessel;

Figures 5a and 5b are front and plan views of an third embodiment of the present invention designed for manual operation;

Figure 6 is a diagrammatic representation of the device of figure 5a and 5b, with the inflatable members shown in an inflated condition;

Figure 7 is a plan view of an inflatable member in an inflated condition and shown with a trailing net of fouling wire;

Figures 8a and 8b show views of the inflatable member of figure 7 in a deflated condition;

Figure 9 shows an end view of a fourth embodiment of the present invention in which a plurality of inflatable members are contained in a common housing;

Figures 10 to 14 show alternative embodiments of the fouling wire attached to the inflatable member shown in the inflated condition;

Figure 15 is a schematic view of a fifth embodiment of the present invention;

Figure 16 is a schematic sectioned representation of the device of figure 15, shown in use;

Figure 17 is a front view of the device of figure 16, shown in the water;

Figure 18 is an end view of a tail section of the device of figure 15;

Figures 19 to 21 are sectioned side views of sixth, seventh and eighth embodiments of the present invention respectively;

Figure 22 is a schematic representation of a ninth embodiment of the present invention;

Figure 23 is a front view of a tenth embodiment of the present invention;

Figures 24 to 27 are schematic plan views of different configurations of the device of figure 23;

Figure 28 is a plan view of the device of figure 23 with the inflatable members discharged;

Figure 29 is a perspective side view of the inflatable member of figure 23, the member shown in the deflated condition;

Figure 30 is a diagrammatic plan view of vessel fitted with a plurality of immobiliser devices of the present invention

Referring now to figures 1 and 2 of the drawings, a sea-faring vessel 1 (figure 2) is fitted with a plurality of immobiliser devices 2 of the present invention. Two such devices 2 are disposed on each of the port and starboard sides of the vessel 1 and a further device is disposed on the stern of the vessel 1. Each of the devices 2 stores an inflatable boom 3 that when deployed is inflated and discharged from a housing 4 fitted to the vessel 1. Inflated booms 3 are shown egressing from the vessel 1 in figure 2 and an exemplary boom 3 is shown in figure 1.

The inflated boom 3 comprises a gas-filled flexible tube 5 around which a fouling line 6 is helically wound and connected thereto by means of eyelets (not shown) in a seam of the inflated boom 3. The fouling line 5 is constructed from a strong elongate flexible element such as metallic wire or cable and is designed to foul the propeller or motor of an approaching vessel by entanglement therewith.

Figure 3 shows a typical housing 4 for stowing the deflated boom on the port or starboard locations of the vessel. The housing 4 comprises a cylindrical shell 7 having an axial tubular chamber 8 in which a deflated boom (not shown) is received. The chamber 8 is closed by a removable cap 9 and an end of the boom is releasably connected to a supply of compressed gas 10 via a non-return valve 11 that is fitted in the end of the boom. The supply of gas 10 is controlled by an electronic circuit and a gas distribution solenoid 12 disposed in the housing 4.

In the event of a threatening approach from another vessel, the immobiliser device is actuated by a coded signal from a handset or a control panel on the bridge of the vessel. This causes gas to be released from the supply by the solenoids and fed to the boom via the non-return valve. The boom is inflated by the gas and expands out of the chamber by forcing the cap out of register with the end of the chamber. When the boom is inflated to a predetermined pressure it is automatically released from the non-return valve and escapes from the housing into the water in the path of the target approaching vessel. When the approaching vessel meets the inflated boom the fouling wire wraps around its propeller and/or motor and inhibits its operation thereby

preventing the threatening vessel from approaching further and unauthorised boarding of the vessel in question. The same device can be used to immobilise a fleeing vessel in certain circumstances.

A stern-mounted immobiliser device, shown in figures 4a-4c has two inflatable booms (hidden) disposed in two adjacent chambers of a cylindrical shell 7 that are connected to a supply of gas (not shown) via a common gas distribution block 12.

An alternative manually operated immobiliser device is shown in figures 5a, 5b and figure 6. It has four inflatable booms that are housed in four equi-angularly spaced cylinders 7 whose internal chambers 8 are linked to a common gas supply, control circuit and manual release non-return valve. In use, the device is manually thrown into the path of the approaching vessel and is remotely actuated by pulling on a line 13 that is attached a central pin 14. Removal of the pin 14 opens communication between the gas supply and the booms which then each inflate and extend from the chambers 8 although they remain attached to the device.

Another embodiment of an inflated boom is shown in figure 7 in which the fouling wire 6 is not only wrapped around the boom 3 but is also woven into a net configuration 15 that flanks the boom 3 at one side. The net 15 may optionally be fitted with tow rings 16 by which the boom 3 may be connected to a winch (not shown) of the vessel and used to tow the threatening vessel. The trailing end of the net 15 has weights 17 attached thereto which serve to keep the net 15 extended in the water. In use, the net 15 offers a greater area of potential contact for the approaching vessel.

A deflated boom 3, shown in figures 8a and 8b, is compressed into a flat disc around which the fouling wire 6 is wrapped. Four such booms 3 are shown stored in a common housing 18 in figure 9. The booms 3 are released one at a time from an exit in the end of the housing indicated by the arrow E. Once a boom 3 has been released the others are automatically indexed towards the exit.

Alternative configurations of the fouling wire are shown in figures 10 to 14, each of which is designed to improve the chances of contact of the device with the

approaching vessel. In each embodiment there is an upstanding configuration of wire 20 that is supported by radially extending inflatable portions 21 of the boom 3. This upstanding configuration 20 is designed to come into contact with the bow of an approaching vessel thereby assisting the trailing net to engage the motor or propeller of the vessel. The net 15 is shown in each case with plastic webs 22 filling some of the holes defined by the fouling wire 6. The presence of the plastics webs 22 encourages the net to be drawn to the bottom of the approaching vessel. In addition, fouling wire trails 6 extend from the end of the net and terminate in a weight disc 17 which is subject to drag in the water and therefore ensures that the net is maintained in a downwardly extended configuration in the water.

A remotely controlled immobiliser device is shown in figures 15 to 18. It comprises a capsule 30 having a front nose 31 cone filled with air, a rear section 32 housing two projectiles 34 and an intermediate section 33 that contains fouling wire 35. The projectiles 34 are hollow and fit together to form an annular disc 36 that is releasably received in the rear section 32 of the capsule 30. Each of the projectiles 34 are tied to an end of the fouling wire 35 that is coiled up inside the intermediate section. In use, the capsule floats in the water and as the target vessel approaches, small charges are remotely activated to dispatch the projectiles 34 outwardly of the capsule 30 as shown in figures 16 and 17. The projectiles 34 carry the fouling wires 35 with them and float on the surface of the water when they land. The approaching vessel is stopped by the fouling wires 35 entangling with the propeller and/or motor of the target vessel as described above.

The capsule may be projected into the sea by an appropriate mechanism fitted to the vessel or alternatively may simply be dropped into the water. Instead of being remotely activated the charges may dispatch the projectiles on contact with the water or they may be activated by a timer when a predetermined time has elapsed after the capsule has been dispatched.

Figures 19 to 21 show embodiments of an immobilising device in the form of a capsule but which incorporates the inflatable booms of earlier designs. The capsule in each case is launched from an open ended cylinder 40.

In the design of figure 19 the capsule 41 has a front nose cone 42 behind which there are two deflated booms 43a, b separated by a gas canister 44. Each boom 43a, b is connected to a respective outlet 45 of the canister via a non-return valve 46 integral with the boom. In use, a first non-return valve 46 is opened by releasing the gas from the canister 44 to inflate the rear boom 43a which provides sufficient thrust to launch the capsule 41 from the cylinder 40. When the capsule 41 contacts the water the second non-return valve 46 is opened to inflate the leading boom 43b. Each of the booms 43a, b is again wrapped in a web of fouling wire 47.

In the design shown in figure 20 the capsule 50 contains a single inflatable boom 51 behind a gas-filled nose cone 52. Propulsion of the capsule 50 from the cylinder 40 is provided by a canister 53 of compressed gas that is connected to the rear of the cylinder 40. Once the capsule 50 contacts the water a valve 54 in the nose cone opens to release the gas and to inflate the boom 51.

The embodiment of the immobiliser shown in figure 21 is similar to that of figure 19 except that the inflatable booms 60a, b are stored in a wound spiral configuration (shown in inset figure to the right). The supply of compressed gas to the booms 60a, b is provided by an intermediate gas canister 61 as before and, optionally, by the nose cone 62 (to the leading boom only).

Figure 22 shows an alternative capsule 70 in which fouling wire 71 are stored in a coiled configuration in a cylindrical chamber 72 behind the nose cone 73. The tail ends of the wires 71 are connected to a drag plate 74 which, when the capsule 70 is in the water, pulls the fouling wires 71 out of the capsule 70 and maintains it in an extended form.

A compact hand-held immobiliser is shown in figures 23 to 29. It comprises a pressurised gas canister 80 on which is mounted a gas distributor 81 having an inlet 82 that engages a neck 83 of the gas canister 80. The inlet 82 is connected to four outlet 84 conduits to each of which is connected a deflated boom 85 that is wound in a coil configuration. The end of each boom 85 has an inlet nozzle 85a (see figure 29) that engages in an outlet conduit 84 of the gas distributor 81. An upper surface 86 of the gas distributor 81 has a protruding actuator pin 87 which is pulled to operate the

device. In use, when the pin 87 is removed it opens a valve in the neck 83 of the gas canister 80 and permits gas to flow through the outlet conduits 84 and into each of the booms 85 which uncoil as they inflate. A timer may be provided to delay opening of the valve after removal of the pin 87 to allow the user time to drop the device into the sea before inflation of the booms 85 commences. Alternatively the device may be lowered by a length of cord attached to the pin 87. A short sharp tug on the cord when the device is in place will release the pin 87 and initiate inflation of the booms 85.

The deflated booms 85 can be arranged on the gas distributor 81 in many different configurations and examples are shown in figures 24 to 27.

Figure 28 shows an alternative configuration of gas distributor 91 with outwardly extending arms 92 forming the outlet conduits. The arrows indicate the direction of flow of the gas into the booms (not shown)

The compact immobiliser may be released into the sea automatically from a small housing fitted to the vessel. An example is shown in figure 30 in which the vessel 100 is fitted with a plurality of immobilisers 101 which are automatically released from a housing when an alarm system is triggered. The alarm system may comprises any known form of radar or other monitoring apparatus. When a threatening vessel 102 approaches and is detected by the alarm system the appropriate immobiliser 101 is released from its housing by sending a release signal to a servo that serves to retain the immobiliser in the housing.

It will be appreciated that numerous modifications to the above described design may be made without departing from the scope of the invention as defined in the appended claims. For example, the boom described above may be designed to float by means other than being inflated. It is also preferably designed to be biodegradable over a period of time.